IS 4841 (1982): Method for determination of density of sintered metallic materials [MTD 25: Powder Metallurgical Materials and Products]

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Indian Standard

METHOD FOR DETERMINATION OF DENSITY OF SINTERED METALLIC MATERIALS

(First Revision)

UDC 669-138·8 : 531·754

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

March 1983

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Indian Standard

METHOD FOR DETERMINATION OF DENSITY OF SINTERED METALLIC MATERIALS

(First Revision)

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Indian Standard

METHOD FOR DETERMINATION OF DENSITY OF SINTERED METALLIC MATERIALS

(First Revision)

0. FOREWORD

0.1 This Indian Standard (First Revision) was adopted by the Indian Standards Institution on 15 December 1982, after the draft finalized by the Powder Metallurgical Materials and Products Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 This standard was first published in 1968. While reviewing the standard, in the light of experience gained during subsequent years, the committee decided to revise this standard, making the following main modifications:

a) A method for calculating the dry density of sintered metallic materials has been included;

b) In this revision only the method for determination of dry density has been laid down. For wet density, the method for determination has been included in IS : 5642-1982*; and

c) Details to be given while reporting the test results, have also been included in the present revision.

0.3 In reporting the result of a test made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS : 2-1960†.

1. SCOPE

1.1 This standard relates to the determination of dry density of sintered metallic materials.

*Method for determination of wet density and interlocking porosity of sintered powder metal structural parts and porous bearings (*first revision*).

†Rules for rounding off numerical values (*revised*).

1.1.1 The method described may be used to determine the apparent density of impermeable sintered compacts.

2. PRINCIPLE OF TEST

2.1 A cleaned test piece is weighed first in air and then in water, after which the density of the material is calculated.

3. TEST APPARATUS

3.1 Analytical Balance — It shall be of sufficient capacity, capable of weighing the test piece to within an accuracy of 0·01 percent.

3.2 Vessel — It shall contain distilled and degassed water to which 1 or 2 drops of a wetting agent have been added. The vessel shall be so dimensioned that it is large enough to accommodate the freely suspended test piece, at the same time, shall not hinder with the correct functioning of the balance.

4. TEST PIECE

4.1 The volume of the test piece shall be at least 0·5 cm^3.

4.2 The test piece shall be rendered free of oil in accordance with the procedure described in IS : 5642-1982*.

4.3 If the test piece is porous, it shall be coated with a non-wetting surface film, that is by dipping it in a 0·1 percent solution of silicone oil in a suitable solvent, or in a 5 percent solution of paraffin wax. The test piece shall be dried to constant mass after being dipped in the solution.

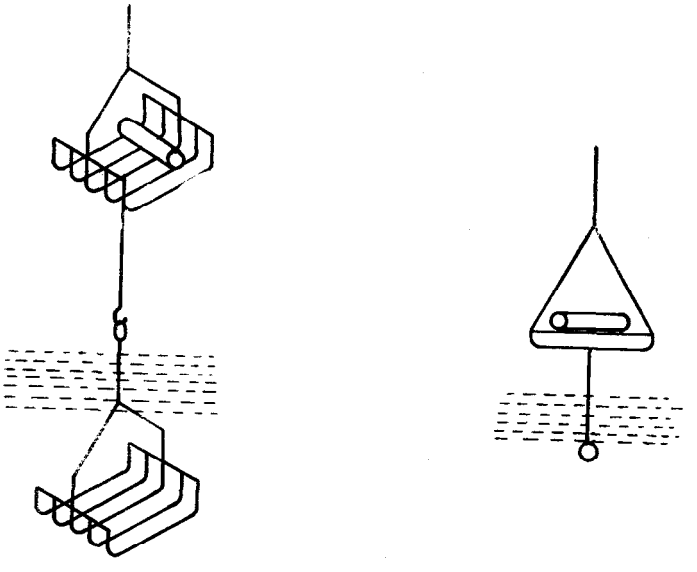
5. TEST PROCEDURE

5.1 Test Temperature — The test piece and the water in the vessel shall be at the same temperature.

5.2 The test piece shall be weighed first in air, as shown in Fig. 1A or 1B and then by fully submerging it in water as shown in Fig. 2A or 2B. The test piece shall be positioned so that the risk for air bubbles forming on its surface is kept to a minimum. It is recommended that a mirror may be used to check for air bubbles. Any air bubbles on the test piece shall be removed with a soft brush.

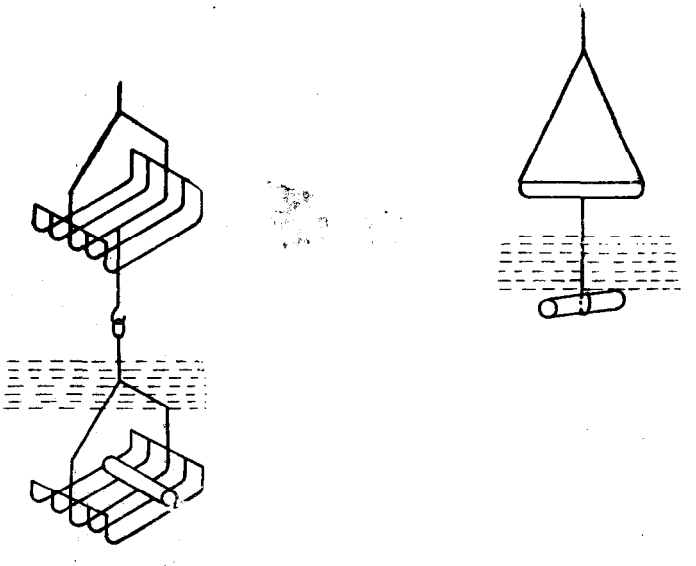
NOTE — The test piece shall be suspended by a wire of suitable diameter and material for immersion in water.

*Method for determination of wet density and interlocking porosity of sintered powder metal structural parts and porous bearings (*first revision*).



1A 1B

FIG. 1 TEST ARRANGEMENTS FOR WEIGHING IN AIR



2A 2B

FIG. 2 TEST ARRANGEMENTS FOR WEIGHING IN WATER

6. CALCULATION

6.1 The dry density of the test piece, ρ, is given by the following formula:

$$\rho = \frac{m_1 \times \rho w}{m_2 - m_3}$$

where:

m_1 = mass of the test piece in air;

m_2 = mass of the test piece and the suspension wire in air;

m_3 = mass of the test piece and the suspension wire, in water; and

ρw = density of water, the value for which, depending on the test temperature, is given in Appendix A.

7. TEST RESULT

7.1 The density of the test piece shall, unless specified otherwise, be reported to an accuracy of $\pm$ 0·25 percent.

8. REPORT

8.1 The test report shall include the following information:

a) Reference to this Indian Standard,

b) All details necessary for identification of the test piece, and

c) The result obtained.

APPENDIX A

(*Clause* 6.1)

The following values may be used for the density of distilled and degassed water at temperatures from 0 to 40°C.

Temperature °C	*Density of Water* g/cm³
0	0·999 867 9
1	0·999 926 7
2	0·999 967 9
3	0·999 992 2
4	1·000 000 0
5	0·999 991 9
6	0·999 968 1
7	0·999 929 5

Temperature °C	*Density of Water* g/cm³
8	0·999 876 2
9	0·999 808 8
10	0·999 727 7
11	0·999 632 8
12	0·999 524 7
13	0·999 404 0
14	0·999 271 2
15	0·999 126 5
16	0·998 970 1
17	0·998 802 2
18	0·998 623 2
19	0·998 433 1
20	0·998 232 3
21	0·998 021 0
22	0·997 799 3
23	0·997 567 4
24	0·997 325 6
25	0·997 073 9
26	0·996 812 8
27	0·996 542 1
28	0·996 262 3
29	0·995 973 5
30	0·995 675 6
31	0·995 369 2
32	0·995 054 2
33	0·994 730 8
34	0·994 399 1
35	0·994 059 4
36	0·993 711 9
37	0·993 356 5
38	0·992 993 6
39	0·992 623 2
40	0·992 245 5

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	Unit	Symbol
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	Unit	Symbol
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	Unit	Symbol	Definition
Force	newton	N	1 N = 1 kg.m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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